

## Study #8 Carrying Capacity

*November 28, 2001*

### 1.0 Introduction/Background

This study will focus on quantitative and qualitative data and conclusions pertaining to the recreation carrying capacity of the Study Area. This type of analysis is sometimes called a recreation carrying capacity analysis.

Recreation “carrying capacity” has been defined in a number of ways; one useful definition is “the level of use beyond which impacts exceed standards” (Shelby and Heberlein 1986). Using Shelby and Heberlein’s method of measuring recreation carrying capacity, capacity levels are developed for four capacity types: ecological, physical/spatial, facility, and social. Based on these capacity types, limiting factors are identified to establish the level at which recreation use will reach capacity. Questions specific to the different types of capacity will be included in Study #13—Recreation Surveys. For example, social carrying capacity will be measured through the use of a question utilizing a 9 point scale, where 1 = not at all crowded and 9 = extremely crowded, to gauge perceived crowding at recreation facilities within the Study Area.

### 2.0 Study Objective

The objective of this study is to determine a sustainable level of recreational facility development and recreational use which will provide high quality recreational opportunities to the project’s primary recreational groups; protect the Study Area’s sensitive and natural resources; and be consistent with the planned operation of the project. This study will assess what level of recreational use is sustainable, compatible, and within the overall capacity of the Study Area throughout the term of the new license. Existing surface water boating use levels will be addressed in Study #7—Reservoir Boating Survey.

### 3.0 Relationship to Relicensing/Need for the Study

This study is needed because Federal Energy Regulatory Commission (FERC) regulations require a comprehensive recreation plan which considers the recreation carrying capacity of the Study Area. The study will investigate the existing capacity of recreation resources within the Study Area by investigating the four types of capacity including ecological, physical/spatial, facility, and social. The study addresses Issue Statement R1—adequacy of existing project recreation facilities, opportunities, and access to accommodate current and future demand. It specifically addresses Issues RE 1, 2, 5-39, 53, 55-56, 60, 61, 64-83, 85, 95, 96, 104, and 105.

### 4.0 Study Area

The Study Area includes Lake Oroville, the lands and waters within and adjacent to (1/4 mile) the FERC project boundary, and adjacent lands, facilities, and areas with a clear project nexus. The Study Area includes the following developed recreation areas and sites:

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- Thermalito Afterbay facilities
  - Thermalito North Forebay facilities
  - Thermalito South Forebay facilities
  - Diversion Pool facilities
  - Spillway Boat Ramp/Overflow Camping
  - Dam/Overlook Area
  - Lake Oroville Visitor Center
  - Bidwell Canyon Marina and other nearby facilities
  - Car-Top Boat Launch Areas (BLAs) such as Stringtown, Dark Canyon, Foreman Creek, Nelson Bar, and Vinton Gulch
  - Low flow channel of the Feather River
  - Clay Pit State Vehicular Recreation Area (SVRA)
  - Feather River fish hatchery (public areas)
  - Loafer Creek facilities
  - Lime Saddle Marina and other nearby facilities
  - Foreman Creek Boat-In Campsite (BIC)
  - Enterprise BLA
  - Craig Saddle BIC
  - Bloomer Primitive BIC
  - Goat Ranch BIC
  - Oroville Wildlife Area (OWA)
  - Selected Primary Equestrian Trailheads
  - Selected Primary Mountain Bike/Hiking Trailheads

## 5.0 General Approach

### *Detailed Methodology and Analysis Procedures*

This study will assess the recreation capacity of the Study Area using various types of capacity considerations. A large body of research exists regarding crowding and resource deterioration in recreation settings. In such research, four types of carrying capacities are delineated (Shelby and Heberlein 1986):

- **Ecological Capacity:** Concerned with the impacts of recreation on the ecosystem, such as the percent of specific types of ground cover, number of certain plants or animals observed, soil compaction, and soil erosion.
- **Physical/Spatial Capacity:** Concerned with the impact of available space on recreation, such as number of people per square foot of flat sleeping areas, number of people per acre or square mile, camping parties per beach, or number of people in critical areas.
- **Facility Capacity:** Concerned with facility impacts, such as number of people, groups, or vehicles per boat ramp, restrooms, parking lots, or campgrounds, visitor-staff ratios, percent occupancy for various facilities, waiting time to use facilities, or number of campground refusals.
- **Social Capacity:** Concerned with visitors' perceptions of surrounding recreational use, and considers factors such as encounters with other parties per hour or day, number of encounters with groups of a particular size or type, percent of nights camped away from others, percent of attraction sites where people are beyond sound and sight of others, or number of people encountered at each attraction site.

Once these four capacity types have been investigated, it is important to identify which type (or types) is a limiting factor(s). A limiting factor is defined as an indicator that puts a cap on the level of recreational use (capacity) at a site or area. The limiting factor often drives decision making regarding capacity determinations and is often the “trigger” that determines when recreation use has reached a level of capacity.

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Different levels of capacity are also important in determining where capacity concerns exist and where management priorities and monitoring programs should be directed. Capacities at the site level and reservoir-wide level need to be assessed. Once these levels have been assessed, overall capacity assessments can be determined for the Study Area. Capacities expressed in absolute numbers of users or vehicles, for example, are unlikely results of this study since capacities are only estimates; capacities may also be expressed in qualitative terms, and absolute numbers or limits change over time.

In summarizing overall recreation capacity at site and reservoir-wide levels, judgments will be made as to whether use levels are below, approaching, at, or exceeding capacity. These judgments will be based on guidelines to be developed for this study. Some of these guidelines will be developed from States Organization for Boating Access (SOBA) and National Recreation and Park Association (NRPA) guidelines and standards, as well as other relicensing studies conducted by EDAW for recreation resources in California and the Pacific Northwest. These guidelines will be developed for this Project based on the four capacity types, not on specific activity types, such as trail use. For example, ecological capacity levels may be based on a range of impacts observed related to evident erosion, vegetation damage observed, or trash accumulation. Physical/spatial capacity levels may be based on the adequacy of the site or area for expansion potential, the distribution of sites, and surface water access per boat. Facility capacity levels may be based on campsite, picnic site, and parking lot capacity utilization, and boat launch wait time acceptance by users. Social capacity levels may be based on user conflicts reported and perceived crowding scores (from survey results) on land and water. These guidelines will be tailored to the Project based on issues unique to Lake Oroville and its surroundings.

In summary, this study framework involves conducting three interrelated tasks:

- Task 1—Data collection for the four capacity types
- Task 2—Identification of limiting factor(s)
- Task 3—Assessment of overall capacity of site, reservoir-wide, and activity levels

#### Task 1—Data Collection for Four Capacity Types

This task involves data collection for four capacity types. The types of data to be collected include:

- **Ecological Capacity.** This assessment will be accomplished through brief on-site observations at each of the recreation sites in the Study Area, along with an assessment of general reservoir shoreline conditions. Important impacts to be noted in the field include litter, sanitation problems, and wetland and riparian vegetation impacts (field data to be collected in Study #11—Recreation and Public Use Impact Assessment). Also important to consider is sensitive shoreline wildlife, plant species, and cultural resources. These resources will be considered using GIS data layers from these other resource areas and terrestrial and cultural resource reports as available. Results of Study #11 will be used and summarized to identify areas where existing recreation use or projected future recreation use will likely cause severe impacts to natural resources, primarily soils, vegetation, sensitive species, and water quality.

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- **Physical/Spatial Capacity.** This assessment will be accomplished through counts of users or activities at each of the facilities in the Study Area. Counts of boats in each of the reservoirs and segments will be addressed in Study #7—Reservoir Boating Survey. Consideration of the physical limitations at each site or use area in the Study Area will be noted with regard to existing uses, as well as the potential for future public recreation development expansion. Property and FERC boundaries at each site will be reviewed via GIS mapping provided by DWR, as will slope and soil mapping. Usable recreational land and water areas will be determined by assessing the needs of the Project's primary recreation activity groups, resource constraints, access limitations, and management restrictions. For example, to determine usable shore fishing areas, shoreline slope, terrain, endangered species habitat, cultural resources and vehicle and foot access will likely be considered. For usable boat fishing areas, water areas off limits to boats by county ordinance and because of hydro operations, will likely be considered.
  - **Facility Capacity.** Facility capacity will be assessed by collecting and analyzing various data. These data sources include: on-site survey counts and user counts provided by operators (Study #9—Existing Recreation Use Study), evaluation of facility conditions (Study #10—Recreation Facility and Condition Inventory), and obtaining information from facility operators (Study #10 and Study #13—Recreation Surveys). The capacity of developed recreation facilities will be summarized. To determine if facility use is at capacity, several factors will be evaluated including: summer weekend capacity rates, number of times capacities are exceeded during summer weekend days, and seasonal capacity utilization of the facilities. These factors will be evaluated using data collected in Study #9. Occupancy rates for facilities will be obtained from the use observation surveys and summaries of overnight facility occupancy records provided by operators (Study #9).
  - **Social Capacity.** This study will analyze the results from specific questions asked in Study #13. Several questions related to social capacity will be included in this parallel study that will be administered at sites in the Study Area. For each land-based site, survey results will be presented for how visitors perceive crowding. The results from this question will reflect the average crowding score for users at each site based on a 9 point scale where 1 = not at all crowded, and 9 = extremely crowded (Shelby and Heberlein 1986). Results will be obtained in a similar fashion for each reservoir based on whether respondents had boated in that reservoir on the day they were contacted (results to be presented in Study #7). Questionnaire responses related to perceptions of crowding and user conflict will be used to assess whether or not various recreational areas are approaching social carrying capacities. Along with these questionnaire responses, Recreation Opportunity Spectrum (ROS)-related survey responses (Driver et al. 1987) will be used to identify the desired experience of visitors versus their actual experiences, along a continuum of semi-primitive experiences to more urban experiences.

#### Task 2—Identification of Limiting Factor(s)

For each site, reservoir segment, and reservoir, conclusions will be made using Task 1 data which addresses which of the four capacity types were limiting factor(s). Qualitative and quantitative data will be used to make these conclusions. For example, the number of campsites available (facility capacity) potentially limits camping if all the campsites are occupied. If the campground has no space to expand, physical capacity is a second indicator to consider.

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If a site is located next to sensitive wildlife or vegetation resources, these resources may be ecologically-limiting factors. Finally, if a site or area is perceived as being extremely crowded, social capacity may be a limiting factor no matter what the use level may be.

Once identified, limiting factors become the focus for assessing recreation capacity at a site or area, or monitoring recreation capacity in the future. While all four capacity types being considered (physical/spatial, facility, ecological, and social) may potentially be limiting factors, typically only a few factors dominate. Qualitative and quantitative data collected in Task 1 will be used in this selection process. A table of limiting factor(s) will be prepared for each site and reservoir.

### Task 3—Assessment of Overall Capacity at the Site-Specific and Reservoir-Wide Levels

Based on the Task 1 assessment of the four capacity types, and the identification of the limiting factors in Task 2, the capacity of geographic areas (site and reservoir) will be assessed. To summarize this analysis, recreation sites and reservoirs will be prioritized from highest to lowest capacity concern. Sites and reservoirs will be graphically presented according to three levels of capacity concern (high, medium, and low priority). Existing GIS mapping will be used as the basis for this graphic. For each geographic recreation area and each primary recreation activity, a table will be prepared which will summarize the condition of each recreational capacity parameter, identify the carrying capacity parameters, and identify priority levels.

## **6.0 Results and Products/Deliverables**

### ***Results***

Utilizing management and impact parameters, the results of this study will address specific site capacities, as well as broader social and environmental capacities of sites, use areas, and activities. The results will be used to set use limits and/or build new facilities to facilitate higher levels of use than what is currently occurring. Theoretical maximum persons-at-one-time (PAOT) and recreation visitor days (RVDs) will be determined and summarized in a table for each recreation facility and the Study Area as a whole and compared to actual occupancy rates. For each recreation facility, ecological, physical/spatial, facility, and social capacities will be determined and discussed. Based on these capacity types, limiting factors will be identified, discussed, and listed for each recreation facility in a summary table. Additionally, the overall capacity of study areas will be listed and discussed.

### ***Products/Deliverables***

The following product will be developed for this study:

- Draft Final Report

The report will contain an executive summary; an introduction including goals and objectives; methods; results; and a discussion.

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## 7.0 Study Plan Coordination and Implementation Strategy

### *Coordination with Other Resource Areas/Studies*

Counts of boats and boating capacity in each of the reservoirs and segments will be addressed in Study #7—Reservoir Boating Survey. Coordination will also be needed with many of the studies being led by the Environmental Work Group.

Studies that will contribute data for use in this study include:

- Study #9—Existing Recreation Use Study
- Study #10—Recreation Facility and Condition Inventory
- Study #11—Recreation and Public Use Impact Assessment
- Study #13—Recreation Surveys

Data required to assess ecological capacity includes terrestrial Threatened and Endangered Species (TES) and cultural resource reports and GIS data layers, such as shoreline wetlands, shoreline riparian vegetation, raptor nest sites, and cultural resources with buffers along the shoreline (assumed confidential).

### *Issues, Concerns, Comments Tracking, and/or Regulatory Compliance Requirements*

This study addresses issue statement R1—adequacy of existing Project recreation facilities, opportunities, and access to accommodate current use and future demand. It specifically addresses issues RE 1, 2, 5-39, 41, 52, 53, 55, 56, 60, 61, 64-83, 85, 95, 96, 104, and 105.

## 8.0 Study Schedule

Data collection: June through October 2002.

Data analysis and report writing: November 2002 through June 2003.

Draft Final Report due: July 2003.

## 9.0 References

Driver, B.L., P.J. Brown, G.H. Stankey, and T.G. Gregoire. 1987. *The Recreation Opportunity Spectrum Planning System: Evolution, Basic Concepts, and Research Needed*. Leisure Sciences. 9:201-212.

Shelby, B. and Heberlein, TA 1986. *Carrying Capacity in Recreation Settings*. Oregon State University Press. Corvallis, OR.